

**California Transmission Planning Group (CTPG)
Technical Study Team Response to
Comments by the California Public Utilities Commission (CPUC) Staff
on CTPG's Proposed 2011 Work Plan**

Comment:

As a step towards consistency and benchmarking among different 33-percent RPS infrastructure planning efforts in the state, the CPUC staff requests that the four "base case load" 33-percent RPS scenarios from the California Public Utilities Commission's (CPUC's) Long-Term Procurement Plan (LTPP) process be included among the cases studied by the CTPG in 2011. The CPUC staff can work with the CTPG to identify and transfer these cases, but a general description of the scenarios and their CREZ-by-CREZ breakdown can be found in the results section of Attachment 2 to the LTPP's Scoping Memo, here: <http://docs.cpuc.ca.gov/efile/RULINGS/130670.pdf>.¹ Please note that the procurement plans submitted by publicly-owned utilities to the Air Resources Board were a key input to the construction of the LTPP scenarios.

The CPUC Staff expects the LTPP's 'Environmentally-Constrained' scenario to be particularly important, as it contains over 9,000 megawatts of small-scale – 20-megawatt or less each – wholesale distribution generation projects. Interest in, and construction of, these types of projects are accelerating rapidly, and such a scenario provides an important and valuable contrast or bookend to other kinds of cases, for infrastructure planning purposes. The unique analytic challenges that these distributed renewables cases present can no longer be sufficient justification for not fully including such cases within the range of futures to be meaningfully assessed. Therefore, the CPUC Staff recommends that the 2011 CTPG studies include a serious treatment of one or more high distributed renewables cases, including clear identification of the analytic challenges and assumptions involved, in order to expedite understanding of such possible futures, and resolution of their analytic challenges."

CTPG Technical Study Team Response:

The CTPG Technical Study Team welcomes the CPUC staff's suggestion to include the four "base case load" 33-percent Renewable Portfolio Standard (RPS) scenarios from the CPUC's LTPP proceedings in the renewable development portfolios to be used in the CTPG's 2011 work plan. The fact that both investor-owned utilities' and municipal utilities' procurement plans are represented in the LTPP RPS scenarios is an attractive aspect of the CPUC staff's recommendation. The CPUC staff's willingness to help the CTPG transfer the LTPP RPS scenarios into CTPG's power flow cases is also appreciated. The CTPG will take the CPUC staff's recommendation under advisement.

Phase 1 of the CTPG's 2011 work plan includes an update of the renewable net short that the CTPG used in its 2010 studies. Phase 2 includes the selection of the renewable development portfolios that will be

¹ These scenarios are also currently being assessed by the ISO in its study of the operational needs associated with a 33-percent RPS.

evaluated in the power flow studies that will be performed in Phase 2. In the CTPG's previous study work, distributed generation additions were accounted for as load reductions and reflected in the renewable net short. If the CTPG decides to undertake an evaluation of the LTPP's "Environmentally-Constrained" generation development scenario (which the CPUC staff believes is "particularly important"), it will be necessary in Phase 1 to account for the portion of the 9000 megawatts that qualifies towards California load-serving entity's RPS obligations. In addition, it will be necessary in Phase 1 to decide whether to account for the 9000 megawatts of small-scale wholesale distribution generation projects by reducing forecast loads or by modeling this distribution-level generation as discrete generators attached to transmission substations that serve load (in which case the specific modeling decisions can be put off to Phase 2).

Finally, if the CTPG decides to undertake an evaluation of the LTPP's "Environmentally-Constrained" generation development scenario it will be necessary to determine what the expected simultaneous output of these resources will be for the month and hour the CTPG chooses to simulate in its power flow studies. The CPUC staff's assistance in defining the simultaneous output of these resources would be appreciated.

Comment:

In the past year the California ISO and the CTPG have each analyzed a number of 33-percent California Renewable Portfolio Standard cases. The two efforts appear to have come to somewhat different conclusions regarding how much added renewable generation could be accommodated by comparable magnitudes of transmission additions. The reason is unclear, but could entail differences in certain key assumptions or study methodologies. For example the CTPG effort emphasized meeting reliability standards under a variety of load and resource contingencies across a large number of RPS cases, whereas the California ISO study considered fewer cases, but also conducted production simulation and deliverability assessments. In any event, to provide clearer comparison and benchmarking between the different studies, and to improve our understanding of forecasting and methodological issues as well as the range of uncertainty, it is essential that in 2011 the California ISO and CTPG study at least one but preferably two to four RPS cases that are common to both efforts (California ISO and CTPG). This should benefit everyone. Consistent with the CPUC staff's first recommendation above, the CPUC staff would offer the CPUC's LTPP scenarios as a starting place for developing such "common cases."

CTPG Technical Study Team Response:

The CTPG Technical Study Team appreciates the CPUC staff's suggestion that both the CTPG and the California ISO use "two to four" RPS scenarios that are common between the two organizations. The CTPG believes there is merit in narrowing the number of renewable development scenarios that are studied since this will help to focus attention on which renewable resources are *likely* to be built, rather than on which renewable resources *could* be built. While consistency between the CTPG and the California ISO as regards assumptions and study methodology seems desirable, CTPG notes that there are other Balancing Authorities (BAs) within California; and these BAs, like the California ISO, have their own transmission-planning processes. If there is value in consistency, it should be pursued on an equal basis among all the CTPG BAs. The CTPG members will consider the CPUC staff's suggestion that the eCTPG,

and the CTPG members that are BAs, use common renewable development scenarios in their 2011 transmission planning processes.

Comment:

It has been recognized that how generation resources are assumed to be redispatched (apparently relative to an underlying WECC power flow case) to accommodate renewable additions for 33-percent RPS study cases can have a significant impact on transmission additions calculated to be needed to meet reliability standards. However, while the CTPG's recently assumed 70-30 redispatch split (70 percent of redispatch downward coming from in-state) is informative, it is hardly the final word, and alternative redispatch should be examined in 2011 to cover a wider range of possibilities and to provide more robust insight. The CPUC staff really doesn't know that the 70-30 split comes closest to the most likely outcome, especially when there are important uncertainties regarding: California renewable integration needs and how they will be met; non-California renewable generation goals, additions and integration needs; and likely future use of intra-hourly scheduling and dynamic transfers across the interties. More fundamentally, what matters is not 'redispatch' (how assumed dispatch varies from an underlying WECC power flow case) but simply the absolute dispatch itself. The dispatch in the underlying WECC power flow cases may or may not be the best starting point for assuming how a very differently constituted electric system will operate by 2020.

In the California ISO's Transmission Planning Process (TPP), dispatch patterns assumed for power flow/reliability studies were informed by hourly dispatch results in production simulations for the corresponding RPS cases. Furthermore, the California ISO's studies of integration requirements under different 20-percent RPS and 33-percent RPS scenarios also used production simulations, and these simulations modeled not only the hourly dispatch to accommodate expected renewable energy, but also the additional impact on system operation of having to commit flexible generation sufficient to manage the variability of substantial wind and solar generation. The above kinds of production simulations provide valuable information for establishing system dispatch assumptions for power flow/reliability studies, including those that the CTPG may run in 2011. Furthermore, closer linkage of reliability and production simulation studies promotes greater consistency and transparency among different 33-percent RPS infrastructure planning efforts.

CTPG Technical Study Team Response:

It is anticipated that Phase 2 of the CTPG's 2011 work will include a set of power flows cases where selected paths are "stressed" prior to the addition of renewable resources. A stressed path flow is achieved by adjusting the pattern of existing generation in the WECC power flow seed case such that the resulting path flow allows reliable operation at the path's maximum rating. The CTPG Technical Study Team also expects to develop a parallel set of cases for Phase 2 in which the flow on a selected path(s) is set at a historically-based flow level prior to the addition of renewable resources.

The CTPG Technical Study Team believes that NERC Standards require that system performance must meet requirements over "all demand levels,"² and prohibit operating at levels which have not been studied.

² In practice, transmission planners run cases for those representative demand levels where the most severe problems are expected to occur and use engineering judgment for the rest of the demand levels. The intent is that the system will be reliable

The set of power flow cases that employ a “stressed” path are structured to comply with these NERC standards. The CTPG Technical Study Team has determined that compliance is achieved by setting up power flows cases in which WECC paths are stressed prior to the addition of renewable resources.

The parallel set of power flow cases – in which flow on a selected path(s) is set at an historically-based flow level prior to the addition of renewable resources – are expected to more-closely approximate the results of production simulation studies. This is because path flows are usually not at their maximum limits due to season load patterns; forced and planned facility outages that derate maximum allowed transfer capability; the availability of resources, particularly hydroelectric generation in both northern California and the Pacific Northwest; and the relative economic efficiency of each Balancing Authority’s generation mix relative to others (i.e., where it may be more economical to back down generation in one Balancing Authority area and instead run generation in other Balancing Authority areas).

In addition, the CTPG Technical Study Team is considering how the results of economic grid simulation studies conducted by the California ISO, and potentially the WECC Transmission Expansion Planning Policy Committee (TEPPC), could be used to adjust a strict heat rate-based economic merit-order decrementing approach for accommodating the output of renewable resources added to the CTPG’s pre-renewable power flow cases. Such adjustments are intended to capture operational complexities (*e.g.*, generator start-up times, start-up costs, ramp rates, minimum down times, *etc.*) that can be modeled in chronologic production simulation models but not in snapshot power flow analysis.

Comment:

There is a growing wealth, but also a growing confusion, of renewable generation-related planning studies. It is essential that reporting for these studies include sufficient consistency and structure to help stakeholders compare and interrelate the different studies and their methods, and even to help interrelate the different components *within* individual studies. There is a strong need for a useful and transparent summary of the generation mix and its dispatch, as assumed and/or modeled for individual studies and cases, in order to efficiently understand, compare and discuss the different kinds of futures being depicted. For example, this would help stakeholders understand and assess how system dispatch (or “redispatch”) varies across different power flow cases and studies, how this compares with production simulation results (hourly and annually), and what might be the implications for interpreting study results. Thus, if different studies (*e.g.*, CTPG and California ISO) started from the same RPS portfolios, what differences might we see in assumed dispatch, and how would this explain any differences in results?

Simply reporting California-wide and WECC-wide annual generation and/or megawatt injection levels (for power flow cases), by generation types such as wind, solar, storage hydro, gas combined cycle *etc.* is almost certainly not granular enough. Greater within-California discrimination by area would be more

under all foreseeable conditions. This practice complies with NERC Standards and Measurements, wherein the Standard states that system performance must be met under “all demand levels” and the Measurement by which this Standard is met shall include “System performance assessments based on simulation testing for selected demand levels over the range of forecast system demands.” FERC Order 693 requires that “critical system conditions and study years be determined by conducting sensitivity studies with due consideration of the range of factors ...”

valuable. On the other hand, providing generator by generator inputs or results is clearly way too much detail. However, something in-between should be workable, and would provide valuable context and insights for comparing different CTPG study cases and especially for comparing CTPG cases with other studies. This would also provide a helpful aid for assessing the generator re-dispatch issue discussed above, by providing an efficient basis for comparing dispatch (or “redispatch”) across different cases and studies. CPUC Staff commented on reporting of generation mix and dispatch (power flow injection) for last year’s CTPG studies, and would like to pursue it farther this year.

CTPG Technical Study Team Response:

The CTPG Technical Study Team welcomes the CPUC’s staff’s suggestions as to how “within-California” areas should be defined for purposes of aggregating the technology-specific generation output modeled in the CTPG’s power flow cases.

Comment:

The final statewide transmission plan released by the CTPG last month identified high potential transmission upgrades or ‘needs’ and also high-potential transmission corridors. These are described as resulting from a two-phase process that was implemented when identification of a “least regrets” plan (valuable across all or most scenarios) was determined to be infeasible at this time, apparently due to the diversity of scenarios. Given these lessons learned from 2010, it will be helpful to discuss with stakeholders what sort of criteria and objectives should be the basis for identifying transmission needs in 2011 studies. The “least regrets” concept still appears to be valuable. In any event, for any set of high priority transmission additions ultimately identified, not only should the magnitude (*e.g.*, gigawatt-hours) of renewable generation enabled by that set of transmission additions be clearly identified, but also the breakdown of renewable resources by type and location should also be identified. It is possible that alternative resource breakdowns, *i.e.*, multiple cases, would be enabled by a particular set of identified transmission needs, in which case these multiple breakdowns (cases) should be identified. While last month’s CTPG reports on a statewide plan and (draft) Phase 4 studies stated that renewables to meet a 22 to 24-percent RPS would be supported by the identified high-priority transmission additions, the basis of this calculation, and exactly which renewables (*e.g.*, CREZs and technologies) would be supported, was unclear, and should be clarified.

CTPG Technical Study Team Response:

Determining which renewable generation is “enabled” by which transmission additions is difficult on a network since, to varying degrees, power from every generator flows on every element of the network.³ In its previous work, the CTPG has employed shift factors as one measure of the relationship between (i) a particular load-renewable resource combination, and (ii) particular transmission elements. Any other suggestions that the CPUC staff has as to how to determine which renewable generation is “enabled” by which transmission additions, would be appreciated.

³ The relationship is much more obvious for radial lines and substations which connect renewable generators to the existing grid.

The CTPG's previous work identified transmission infrastructure additions that mitigated reliability criteria violations that appeared with a given renewable resource development portfolio sufficient to meet California's 33-percent RPS goal, assuming a specific set of underlying system conditions. No doubt there are many subsets of the previously identified transmission infrastructure additions that would mitigate reliability criteria violations which arise with different subsets of the previously studied renewable resource development portfolios. In addition, changing the underlying system conditions, such as redispatching fossil-fired generation out of merit-order or removing the 70/30 in-state/out-of-state decrementing rule,⁴ would likely change these subsets, perhaps significantly.

The "high potential" transmission upgrades identified in the CTPG's Phase 3 Study Report mitigate reliability criteria violations that occur when renewable resources are added in an amount constituting a 22- to 24-percent range of achieved RPS (assuming fossil-fired generation is redispatched in merit-order subject to the 70/30 in-state/out-of-state decrementing rule). This is one subset of the previously identified transmission infrastructure additions that would mitigate reliability criteria violations which arise with one subset of the previously studied renewable-resource development portfolios.

The CTPG notes that efforts were made in the 2010 Phase 3 study to determine whether the "high potential" transmission upgrades would mitigate reliability criteria violations for geographically different, and larger, subsets of the previously studied renewable resource development portfolios. The results indicated that when a strict merit-order redispatch of fossil-fired generation was used (subject to the 70/30 in-state/out-of-state decrementing rule), the "high potential" transmission upgrades were not effective in mitigating reliability criteria violations that occurred -- regardless of the geographic distribution of renewable resources -- once the subsets of the previously studied renewable resource development portfolios got beyond the 22- to 24-percent RPS range. In other words, above the 22- to 24-percent RPS range, results were insensitive to the location of the renewable resources. The CTPG did not explore whether the results were sensitive to the strict merit-order redispatch assumption or to the 70/30 in-state/out-of-state decrementing rule.

⁴ Under the "70/30 in-state/out-of-state decrementing rule", it is assumed that renewable energy will displace the energy that would have otherwise been received from existing resources, with seventy percent of the displaced (or "decremented") energy attributed to in-state sources and thirty percent from out-of-state sources.